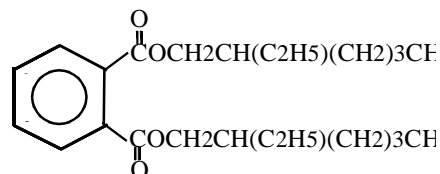


BIS(2-ETHYLHEXYL)PHTHALATE

Bis(2-ethylhexyl)phthalate is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 117-81-7

Molecular Formula: $C_{24}H_{38}O_4$



Bis(2-ethylhexyl)phthalate is a colorless liquid with a slight odor. It is miscible with mineral oil and hexane, and soluble in most organic solvents. Bis(2-ethylhexyl)phthalate is insoluble in water (NTP, 1994a).

Physical Properties of Bis(2-ethylhexyl)phthalate

Synonyms: DEHP; 1,2-benzenedicarboxylic acid bis(2-ethylhexyl) ester; Octoil; di(2-ethylhexyl)phthalate; dioctal phthalate

Molecular Weight:	390.54
Boiling Point:	230 °C at 5 mm Hg
Melting Point:	-50 °C
Flash Point:	218 °C (425 °F)
Vapor Density:	16 (air = 1)
Density/Specific Gravity:	0.9861 at 20/20 °C
Vapor Pressure:	1.32 mm Hg at 200 °C (water = 1)
Log Octanol/Water Partition Coefficient:	5.11
Water Solubility:	0.3 mg/l at 25 °C
Henry's Law Constant:	1.1×10^{-5} atm·m ³ /mole
Conversion Factor:	1 ppm = 15.9 mg/m ³

(Howard, 1990; HSDB, 1991; Merck, 1983; Sax, 1989; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Bis(2-ethylhexyl)phthalate is primarily used as one of several plasticizers in polyvinyl chloride resins used for fabricating flexible vinyl products. It has also been reported as being used as a replacement for polychlorinated biphenyls (PCBs) in dielectric fluids for electric capacitors and in vacuum pumps (NTP, 1994a; Merck, 1989).

The primary stationary sources that have reported emissions of bis(2-ethylhexyl)phthalate in California are furniture and fixtures manufacturing, and lumber and wood products manufacturing (ARB, 1997b).

B. Emissions

The emissions of bis(2-ethylhexyl)phthalate from stationary sources in California are estimated to be at least 104,000 pounds per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

Bis(2-ethylhexyl)phthalate has been suggested as a possible natural product in animals and plants (Howard, 1990).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of bis(2-ethylhexyl)phthalate. However, data from other studies have indicated concentrations of bis(2-ethylhexyl)phthalate in United States rural areas to range from 0.14 to 1.0 parts per billion (ppb) or 2,226 to 15,900 nanograms per cubic meter (ng/m^3), and greater than 0.92 ppb, or 14,628 ng/m^3 in urban areas (Howard, 1990).

INDOOR SOURCES AND CONCENTRATIONS

A field study conducted in southern California measured bis(2-ethylhexyl)phthalate levels inside 125 homes. At each home, 2 consecutive 12-hour samples were collected. Concurrent samples were also collected outside of 65 of those homes. The average indoor concentration was 120 nanograms per cubic meter (ng/m^3). Indoor levels were approximately twice as high as outdoor levels (ARB, 1992b).

In a study in Woodland, California, concentrations were highest inside cars where they averaged 190 ng/m^3 . Indoor levels averaged 59 ng/m^3 , and outdoor levels were below the quantifiable limit of 57.4 ng/m^3 . Personal exposure levels averaged 86 ng/m^3 . Levels in all environments were highly variable (ARB, 1992b).

ATMOSPHERIC PERSISTENCE

Bis(2-ethylhexyl)phthalate partitions between the gas and particle phases in the atmosphere. In the gas phase, bis(2-ethylhexyl)phthalate will react with the hydroxyl (OH) radical, at a rate constant of $2.0 \times 10^{-11} \text{ cm}^3 \text{ molecule}^{-1} \text{ s}^{-1}$. With this rate constant, the calculated half-life and lifetime of bis(2-ethylhexyl)phthalate due to gas-phase reaction with the OH radical are 12 hours and 17 hours, respectively. Bis(2-ethylhexyl)phthalate in the particle-phase is subject to wet and

dry deposition. The average half-life and lifetime for particles and particle-associated chemicals in the troposphere is estimated to be about 3.5 to 10 days and 5 to 15 days, respectively (Balkanski et al., 1993; Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of April 1996, bis(2-ethylhexyl)phthalate contributed to the total cancer risk in 6 of the approximately 550 risk assessments reporting a total cancer risk equal to or greater than 1 in 1 million (OEHHA, 1996a)..

For non-cancer health effects, bis(2-ethylhexyl)phthalate contributed to a total hazard index greater than 1 in 1 of the risk assessments reporting a total chronic hazard index greater than 1 (OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to bis(2-ethylhexyl)phthalate are inhalation and ingestion.

Non-Cancer: Exposure to bis(2-ethylhexyl)phthalate can cause irritation of the eyes and mucous membranes, nausea and diarrhea (Sittig, 1991). Although there is no information on chronic health effects in humans, increased lung and liver weights have been reported in animals exposed through inhalation (NTP, 1994a).

A chronic non-cancer Reference Exposure Level (REL) of 70 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) is listed for bis(2-ethylhexyl)phthalate in the California Air Pollution Control Officers Association Air Toxics “Hot Spots” Program, Revised 1992 Risk Assessment Guidelines. The toxicological endpoints considered for chronic toxicity are the gastrointestinal system and liver (CAPCOA, 1993). The United States Environmental Protection Agency (U.S. EPA) has established an oral Reference Dose (RfD) of 0.02 milligrams per kilogram per day based on increased relative liver weights in guinea pigs. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic, non-cancer effects. A Reference Concentration (RfC) has not been established by the U.S. EPA.

No information is available on adverse reproductive or developmental effects of bis(2-ethylhexyl)-phthalate in humans. Oral exposure to bis(2-ethylhexyl)phthalate has resulted in birth defects and testicular toxicity in rats and mice (U.S. EPA, 1994a).

Cancer: No information is available on carcinogenic effects of bis(2-ethylhexyl)phthalate in humans. Hamsters, exposed by inhalation to a very low dose, did not exhibit significantly increased tumor development. Rats and mice developed liver tumors following oral exposure

(U.S. EPA, 1994a).

The U.S. EPA has classified bis(2-ethylhexyl)phthalate in Group B2: Probable human carcinogen based on sufficient animal but no human evidence. The U.S. EPA has calculated an oral unit risk estimate of 4.0×10^{-7} (microgram per liter or $\mu\text{g/l}$)⁻¹. The U.S. EPA estimates that if an individual were to ingest water containing bis(2-ethylhexyl)phthalate at 3 $\mu\text{g/l}$, over an entire lifetime, that person would theoretically have no more than a 1 in 1 million increased chance of developing cancer (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified bis(2-ethylhexyl)phthalate in Group 2B: Possible human carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that bis(2-ethylhexyl)phthalate (di(2-ethylhexyl)phthalate) is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California for bis(2-ethylhexyl)phthalate is 2.4×10^{-6} (microgram per cubic meter)⁻¹ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 $\mu\text{g/m}^3$ of bis(2-ethylhexyl)phthalate is estimated to be no greater than 2.4 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 8.4×10^{-3} (milligram per kilogram per day)⁻¹ (OEHHA, 1994).